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(73) Proprietor: **THE BABCOCK & WILCOX COMPANY**
1010 Common Street, P.O. Box 60035
New Orleans, Louisiana 70160 (US)

(72) Inventor: **Sherrick, Ronald Eugene**
824 Sheridan Drive
Lancaster Ohio 43130 (US)
Inventor: **Ackerman, Dean Curtis**
5774 Tent Church Road
Lancaster Ohio 43130 (US)
Inventor: **Draxton, Dean Erle**
P O Box 8047
Rapid City South Dakota 57701 (US)
Inventor: **Matthews, John Clarence**
740 King Street
Lancaster Ohio 43130 (US)
Inventor: **Smith, Don Williams**
888 Houfek Drive
Lancaster Ohio 43130 (US)
Inventor: **Stevens, John Gregory**
83 Moon River Lane
Thornville Ohio43076 (US)

(74) Representative: **Williams, Trevor John et al**
J.A. KEMP & CO. 14 South Square Gray's Inn
London WC1R 5EU (GB)

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Description

This invention relates to a long retracting sootblower for boiler cleaning and particularly to one having an indexing lance tube drive system.

Sootblowers are used to project a stream of blowing medium such as water, air or steam against heat transfer surfaces within large scale boilers to cause slag and ash encrustations to be removed. The blowing medium impact produces mechanical and thermal shock which causes these adhering layers to be removed. One general category of sootblowers is known as the long retracting type. These devices have a retractable lance tube which is periodically advanced into and withdrawn from the boiler and is simultaneously rotated such that one or more blowing medium nozzles at the end of the lance tube project jets tracing helical paths.

Many conventional sootblowers, such as the so-called "IK" sootblower, found in US-A-3 439 376, include a lost motion device which causes the nozzles to return along a helical path that bisects the helical path of forward travel. This indexing enables surfaces that were not cleaned during extension to be subjected to blowing medium upon retraction. Although the lance tube nozzles trace different helical paths upon extension and retraction, the positions of these helical paths are nonetheless fixed. Heat transfer surfaces continually subjected to impact by blowing medium suffer from erosion and wear. Furthermore, areas lying between the helical paths of the nozzle jets can sometimes escape adequate cleaning. In view of the foregoing, there is a need to provide a long retracting sootblower device having an indexing mechanism which provides a large number of different yet predictable helical paths traces by the lance tube nozzles.

US-A-4 399 773, upon which is based the prior art portion of claim 1, discloses a sootblower having an indexing drive system which displaces the nozzle helical paths slightly upon each sootblower actuation cycle, and thus overcomes the abovementioned disadvantages by using a turning device and slipping clutch.

As compared therewith, the present invention, as defined in claim 1, uses a very simple mechanical indexing system which causes the pinion gear meshing with the rack to advance with respect to the rack upon each actuation cycle and which, due to its simplicity, is very well suited for use in the rugged environment surrounding a typical sootblower. Due to the geared connection between the lance tube longitudinal and rotational drive systems, such drive pinion indexing has the effect of causing a slight change in the position of the helical paths traced by the lance nozzles upon each actuation cycle. The indexing mechanism of the invention operates automatically and accurately and can be incorporated into new sootblowers as well as many existing sootblowers as a very simple retrofit application. Further developments of the invention are claimed in the dependent claims.

The invention is more fully described with reference to the accompanying drawings in which.

Figure 1 is a pictorial view showing a long retracting sootblower incorporating the indexing features of the present invention.

Figure 2 is a pictorial side view showing the helical paths traced by the lance tube nozzles upon extension and retraction for the sootblower shown in Figure 1.

Figure 3 is a simplified pictorial view showing the drive train arrangement of the sootblower carriage which causes extension and rotation of the lance tube of the sootblower shown in Figure 1.

Figure 4 is a cross-sectional view taken along lines 4-4 from Figure 1 showing internal components of the carriage.

Figure 5 is an inverted pictorial view of an indexing rack assembly according to the present invention shown with a carriage driving pinion.

Figure 6 is a side view of the rack shown in Figure 5.

Figure 7 is a top view of the rack shown in Figure 5.

A sootblower including the improvements of the present invention is shown in Figure 1 and is generally designated there by reference number 10. Sootblower 10 principally comprises frame assembly 12, lance tube 14, feed tube 16, and carriage 18. Sootblower 10 is shown in its normal resting position. Upon actuation, lance tube 14 is extended into and retracted from a boiler (not shown) and is simultaneously rotated.

As best shown in Figure 4, frame assembly 12 includes a generally rectangularly shaped frame box 20 which forms a housing for the entire unit. Carriage 18 is guided along two pairs of tracks located on opposite sides of frame box 20, including lower tracks 22 and 24, and upper tracks 26 and 28. Tracks 22 through 28 are made from angle iron stock which is connected to frame box 20 by threaded fasteners or welding. Toothed rack assemblies 32 and 34 are rigidly connected to upper tracks 26 and 28, respectively, and are provided to enable longitudinal movement of carriage 18. Frame assembly 12 is supported at a wall box (not shown) which is affixed to the boiler wall or another mounting structure, and is further supporting by rear support bracket 36.

Carriage 18 drives lance tube 14 into and out of the boiler and includes drive motor 40 and gear box 42 which is enclosed by housing 44. Carriage 18 drives a pair of pinion gears 46 and 48 which engage rack assemblies 32 and 34 to advance carriage 18 and lance tube 14. Bearings 58 and 59 engage with tracks 22 through 28 to support carriage 18.

Feed tube 16 is attached at one end to rear

bracket 52 and conducts blowing medium which is controlled through the action of poppet valve 54. Poppet valve 54 is actuated through linkages 56 which are engaged by carriage 18 to begin blowing medium discharge upon extension of lance tube 14, and cuts off the flow once the lance tube and carriage return to their idle retracted position. Lance tube 14 overfits feed tube 16 and a fluid seal between them is provided by a packing gland (not shown) so that blowing medium is conducted into the lance tube for discharge from nozzles 64.

Coiled electrical cable 60 conducts power to drive motor 40 as it moves with carriage 18. Front support bracket 62 includes bearings which support lance tube 14 during its longitudinal and rotational motion. For long lance tube lengths, an intermediate support 66 may be provided to prevent excessive bending deflection of the lance tube.

Figure 3 provides a pictorial view of the drive train within gear box 42 of carriage 18. Drive motor 40 transmits power through output shaft 68, then through primary spur gears 70 and 72, and into primary output shaft 74. Primary output shaft worm gear 76 meshes with worm spur gear 78 causing rotation of shaft 80. Shaft 80 directly drives rotation bevel gear 82 which meshes with hub bevel gear 84, which is fixed to lance tube 14. Accordingly, bevel gears 82 and 84 impart rotational motion onto lance tube 14 in response to energization of motor 40. Shaft 80 also drives a pair of translation spur gears 88 and 90 which drive translation shaft 92. Pinion gears 46 and 48 (not shown) are affixed to the opposite ends of shaft 92 and mesh with rack assemblies 32 and 34, as previously explained.

As is evident from Figure 3, due to the direct gear interconnections between the translation and rotational movements of lance tube 14, a fixed relationship in these motions is provided. Figure 2 graphically illustrates the helical paths traced by a pair of diametrically opposed lance tube nozzles 64 during the extension and retraction movements of lance tube 14 for a conventional sootblower. Helical path 96 shown in full lines represents the paths traced by nozzles 64 during extension. For some designs of sootblowers 10, a lost motion device is positioned at hub 84 which introduces an indexing of the helical paths, such that upon retraction, the helix represented by phantom line 98 traces a path which lies between the paths of helix 96. Even without such a specific lost motion mechanism, drive train backlash is often sufficient to cause such displacement of the extension and retraction helical paths. As mentioned previously, such indexing is provided to enhance cleaning performance and somewhat reduces erosion and wear of the impacted surfaces. However, such indexing does not eliminate such problems since the path positions are fixed. Moreover, significant areas remain between the paths which may not be cleaned adequately. An indexing system is provided in accordance with this invention which changes the positioning of helical paths 96 and 98 in a predictable manner each time sootblower 10 is actuated.

Figures 5 through 7 illustrate rack assembly 32 which incorporates an indexing mechanism in accordance with this invention. In order to simplify this description, only rack assembly 32 will be described in detail, it being understood that rack assembly 34 is identical in configuration and operation. Rack assembly 32 includes a fixed toothed segment 106 and a longitudinally indexible toothed segment 108. Both rack sections 106 and 108 include narrowed ends 110 and 112 which allow them to interfit in overlapping fashion as shown in Figure 5, while providing engagement for the full width of pinion gear 46. Other means for overlapping the rack segments could be used with equal success such as a dove-tail joint or side-by-side racks used with a wide pinion gear. Indexible section 108 is mounted to support rail 26 by threaded fasteners 114 which support slide blocks 115 fitting through longitudinally extending slots 116 and 118. Blocks 115 do not firmly clamp against indexible section 108, thus enabling that section to undergo longitudinal displacements. Spring bracket 120 supports coil spring 122 and adjustable stop screw 124. Coil spring 122 urges indexible section 108 to the position shown in Figures 5 and 6, in which sections 110 and 112 completely overlap each other. In this position, the interengagement of the teeth of rack sections 106 and 108 properly mesh with pinion gear 46. As an alternative to the use of spring 122, numerous other compliant devices could be employed such as pneumatic cylinders, etc. Stop screw 124 is adjusted so that longitudinal movement of indexible rack segment 108 toward the right with respect to Figure 6 is equal to one tooth (pitch) distance, as designated by dimension "P" shown in Figure 6. Alternately, the indexing motion distance could be a multiple of the pitch spacing. Thus, indexible rack 108 is movable between two extreme positions, both of which provide proper meshing with pinion gear 46.

Rack assemblies 32 and 34 are mounted to rails 26 and 28 such that indexible portion 108 is located furthest from the boiler (although the opposite arrangement could be used). Figure 6 shows pinion gear 46 in its initial position in phantom lines prior to sootblower actuation. In operation, once drive motor 40 is energized to advance the lance, pinion gear 46 acts on indexible rack segment 108 which accelerates carriage 18 from rest, causing a reaction force which compresses coil spring 122. Once the indexing motion of section 108 is completed, pinion gear 46 advances carriage 18. Once the pinion gear 46 is no longer meshing with indexible segment 108, that rack section is permitted to return to its normal position shown in Figures 5 and 6 under the influence of coil spring 122. Once carriage 18 is advanced to fully

extend lance tube 14, it reverses its motion to return to the idle position. Upon such reverse motion, pinion gear 46, as shown in full lines in Figure 6, re-engages with indexible segment 108. Accordingly, each actuation cycle of sootblower 10 causes pinion gears 46 and 48 to advance a fixed amount (e.g. one tooth) with respect to the fixed portion of rack segments 106 and 108. This indexing also causes the positioning of helixes 96 and 98 to be displaced since the longitudinal and rotational lance tube drive mechanisms are geared together and the phasing between pinion gears 46 and 48, and rack assemblies 32 and 34 establish the helix orientations. Such indexing is illustrated by lines 126 in Figure 2 which are partial tracings of various helixes displaced over a succession of actuation cycles. The total number of unique helical paths for a particular sootblower is a function of the extent of indexing motion in the rack, and the gearing relationships within gear box 42 between the pinion drive shaft and the driven member connected to lance tube 14.

Due to the constantly changing helix positions, erosion of particular areas of the boiler due to repeated blowing medium impact is reduced. As outlined previously, as a means of increasing the difference in positions between successive helical paths, rack portions 106 and 108 could be modified, or stop screw 124 adjusted to cause indexing motion equal to two or more pitch spacings of the racks. Rack assemblies 32 and 34 are configured to enable them to be used in place of sections of conventional unitary racks presently used in sootblowers. Therefore, many present sootblowers could be retrofitted with rack assemblies 32 and 34 which provide the indexing capability.

Claims

1. A sootblower having a lance tube (14) with one or more nozzles (16) for projecting a stream of blowing medium against surfaces within a boiler, said lance tube being arranged in use periodically to be advanced into and out of the boiler and simultaneously to be rotated such that the stream of blowing medium projecting from the nozzle traces a helical path, said sootblower comprising : drive train means (42) for driving said lance tube to undergo said longitudinal and rotational motions in a synchronised manner thereby causing said nozzles to trace said helical paths, said drive train means being carried by a movable carriage (18) coupled to said lance tube (14) and including a drive motor (40) driving said lance tube (14) for rotation and driving at least one pinion gear (46, 48) meshing with a longitudinal toothed rack (32, 34) for driving said lance tube longitudinally, and indexing means (108, 124) for displacing the position of said helical path from one sootblower actuation cycle to another such that the helical paths traced by said nozzle are longitudinally offset between said actuation cycles, characterised in that said indexing means comprises said rack having a fixed rack section (106) and a movable rack section (108), said movable rack section being shiftable between longitudinally displaced first and second positions, and means for moving said movable rack section (108) to said first position during a portion of the actuation cycle of said sootblower, and for moving said movable rack section to said second position during another portion of the actuation cycle of said sootblower at a time when the movable section (108) is engaged by the pinion (46), whereby said pinion gear is indexed with respect to said rack (32) upon each actuation cycle, said longitudinally displaced first and second positions being displaced by a distance equal to the tooth pitch spacing or to a multiple of the tooth pitch spacing of said rack.

2. A sootblower according to claim 1, wherein said means for moving the movable rack section (108) comprises biasing means (122) acting on said movable rack section (108) urging it to said first position whereby rotation of said pinion gear (46) in one direction when meshing with said movable rack section (108) urges said movable rack section to move to said second position against said biasing means (122), said movable rack section (108) being returned to said second position by said biasing means (122) when said pinion gear (46) is not engaging said movable rack section (108).

3. A sootblower according to claim 1 or 2, wherein said rack sections (108, 106) include cut-away overlapping end portions (110, 112).

Ansprüche

1. Rußbläser mit einer Rohrspitze (14) mit einer oder mehreren Düsen (16) zum Richten eines Strahls von Blasmaterial auf Oberflächen innerhalb eines Boilers, wobei die Rohrspitze so ausgelegt ist, daß sie in Benutzung periodisch in den und aus dem Boiler bewegt wird und sich dabei gleichzeitig dreht, so daß ein von der Düse ausgehender Blasmaterialastrom eine Spiralbahn verfolgt, wobei der Rußbläser aufweist : Eine Getriebeeinrichtung (42) zum Antrieb der Rohrspitze zu der Längs- und Drehbewegung in synchronisierter Weise, wodurch die Düsen zum Verfolgen der Spiralbahnen veranlaßt werden, wobei die Getriebeeinrichtung von einem beweglichen Wagen (18) getragen wird, der mit der Rohrspitze (14) verbunden ist und einen Antriebsmotor (40) enthält, der die Rohrspitze (13) zur Drehung antriebt und wenigstens ein Zahnrad (46, 48) antreibt, das in eine längsgerichtete Zahnstange (32, 34) zum Längsantrieb der Rohrspitze eingreift, und eine Weiterstelleinrichtung (108, 124) zum Verschieben der Positionen

der Spiralbahnen von einem Betätigungszyklus des Rußbläsers zum anderen, so daß die von den Düsen verfolgten Spiralbahnen zwischen des Betätigungszyklen in Längsrichtung veretzt werden, dadurch gekennzeichnet, daß die Weiterstelleinrichtung mit der Zahnstange versehen ist, die einen festen Zahnstangenabschnitt (106) und einen beweglichen Zahnstangenabschnitt zwischen einer in Längstrichtung voneinander entfernten ersten und zweiten Position verschiebbar ist, und Mittel aufweist zum Bewegen des beweglichen Zahnstangenabschnitts (108) zu der ersten Position während eines Teils des Betätigungszyklus des Rußbläsers und zum Bewegen des beweglichen Zahnstangenabschnitts zu der zweiten Position während eines anderen Teils des Betätigungszyklus des Rußläsers, während dessen das Zanhrad (46) in den beweglichen Abschnitt (108) eingreift, wodurch das Zahnrad in bezug auf die Zahnstange (32) bei jedem Betätigungszyklus weitergestellt wird, wobei die in Längsrichtung entfernte erste und zweite Position um einen Abstand gleich einem Zahnabstand oder einem Vielfachen des Zalhnabstandes der Zahnstange voneinander entfernt sind.

2. Rußbläser nach Anspruch 1, wobei das Mittel zur Bewegung des beweglichen Zahnstangenabschnitts (108) Vorspannmittel (122) enthält, die auf den beweglichen Zahnstangenabschnitt (108) einwirken und ihn zu der ersten Position drücken, wodurch die Drehung des Zahnrades (46) in eine Richtung, wenn es in den beweglichen Zahnstangenabschnitt (108) eingreift, den beweglichen Zahnstangenabschnitt zur Bewegung zu der zweiten Position gegen die Vorspannmittel (122) zwingt, wobei der bewegliche Zahnstangenabschnitt (108) durch die Vorspannmittel (122) zu der zweiten Position zurückgeführt wird, wenn das Zahnrad (46) nicht in den beweglichen Zahnstangenabschnitt (108) engreift.

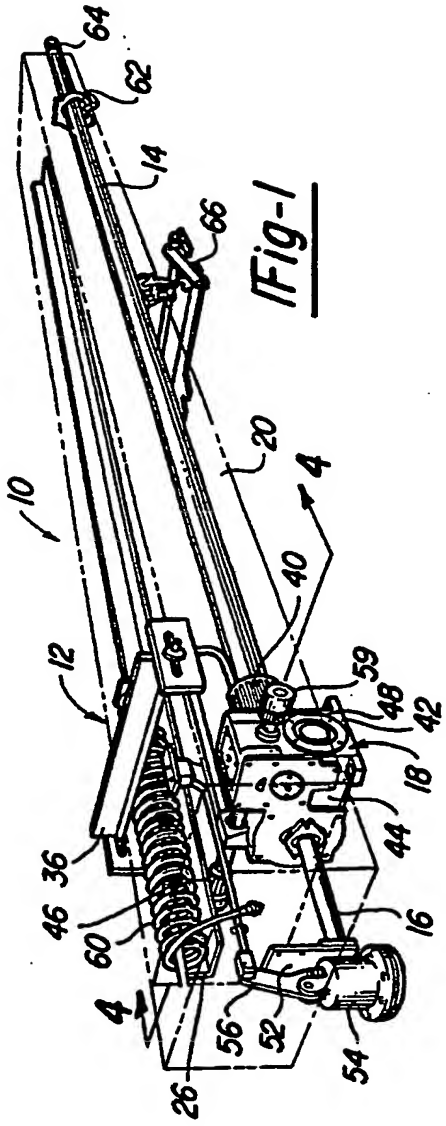
3. Rußbläser nach Anspruch 1 oder 2, wobei die Zahnstangenabschnitte (108, 106) ausgeschnittene überlappende Endbereiche (110, 112) aufweisen.

Revendications

1. Souffleur de suie ayant un tube-lance (14) avec une ou plusieurs buses (16) pour projeter un courant de milieu de soufflage contre les surfaces à l'intérieur d'une chaudière, ledit tube-lance étant disposé, lors de l'utilisation, pour être avancé périodiquement à l'intérieur et à l'extérieur de la chaudière, et pour être tourné simultanément de sorte que le courant de milieu de soufflage projeté par la buse trace un chemin hélicoïdal, ledit souffleur de suie comportant : des moyens (42) formant un train d'entraînement pour entraîner ledit lance-tube afin qu'il subisse lesdits mouvements longitudinaux et de rotation d'une façon synchronisée, faisant par conséquent tracer par lesdites buses lesdits chemins hélicoïdaux, lesdits moyens formant train d'entraînement étant supportés par un chariot mobile (18) couplé audit tube-lance (14) et comportant un moteur d'entraînement (40) entraînant ledit tube-lance (14) pour sa rotation et entraînant au moins un engrenage (46, 48) engrené avec une crémaillère longitudinale (32, 34) pour entraîner ledit tube-lance longitudinalement, et des moyens d'indexage (108, 124) pour déplacer la position dudit chemin hélicoïdal par rapport audit premier cycle d'actionnement de souffleur de suie vers un autre de tels sorte que les chemins hélicoïdaux tracés par ladite buse soient longitudinalement décalés entre lesdits cycles d'actionnement, caractérisé en ce que lesdits moyens d'indexage comportent ladite crémaillère, ayant une section (106) de crémaillère fixe et une section (108) de crémaillère mobile, ladite section de crémaillère mobile pouvant être déplacée entre des première et deuxième positions décalées, et des moyens pour déplacer ladite section (108) de crémaillère mobile vers ladite première position durant une partie du cycle d'actionnement dudit souffleur de suie, et pour déplacer ladite section de crémaillère mobile vers ladite deuxième position durant une autre partie du cycle d'actionnement dudit souffleur de suie à l'instant où la section mobile (108) est engrenée avec l'engrenage (46), grâce à quoi ledit engrenage est indexé par rapport à ladite crémaillère (32) lors de chaque cycle d'actionnement, lesdites première et deuxième positions longitudinalement décalées étant décalées d'une distance égale à l'espacement entre deux dents ou un multiple de l'espacement entre deux dents de ladite crémaillère.

2. Souffleur de suie selon la revendication 1, dans lequel lesdits moyens pour déplacer la section (108) de crémaillère mobile comportent des moyens de décalage (122) agissant sur ladite section (108) de crémaillère mobile de façon à la guider vers ladite première position, grâce à quoi la rotation dudit engrenage (46) dans une direction lorsqu'il s'engrène avec ladite section (108) de crémaillère mobile pousse ladite section de crémaillère mobile à se déplacer vers ladite deuxième position à l'encontre desdits moyens (122) de décalage, ladite section (108) de crémaillère mobile étant envoyée dans ladite deuxième position par lesdits moyens (122) de décalage lorsque ledit engrenage (46) ne s'engrène pas avec ladite section (108) de crémaillère mobile.

3. Souffleur de suie selon la revendication 1 ou 2, dans lequel lesdites sections (108, 106) de crémaillère comportent des parties d'extrémité (110, 112) se chevauchant et entaillées.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54
26

Fig-1

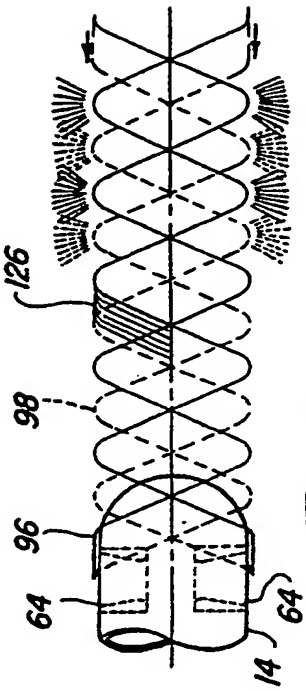
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Fig-2

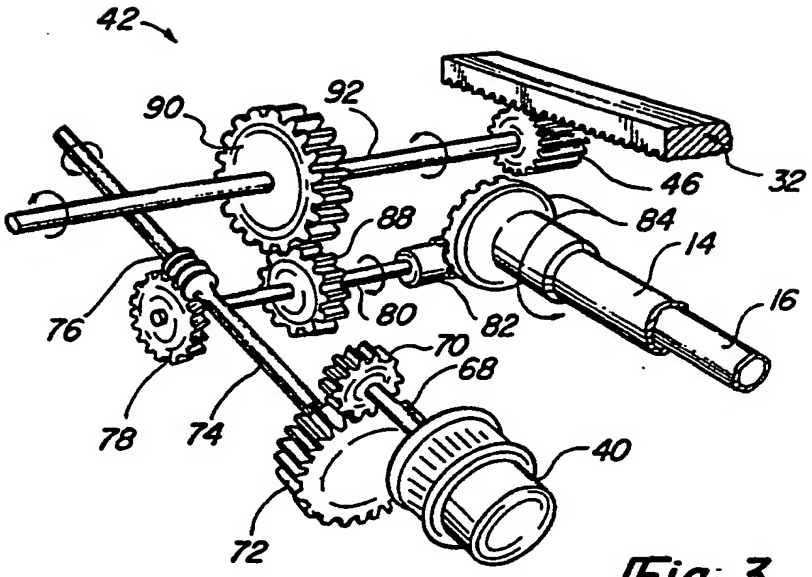
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Fig-3

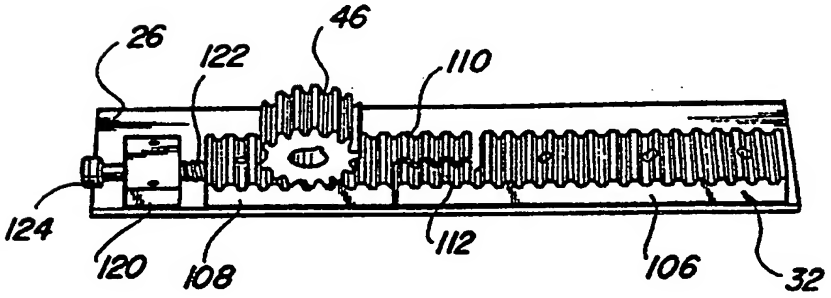
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Fig-5

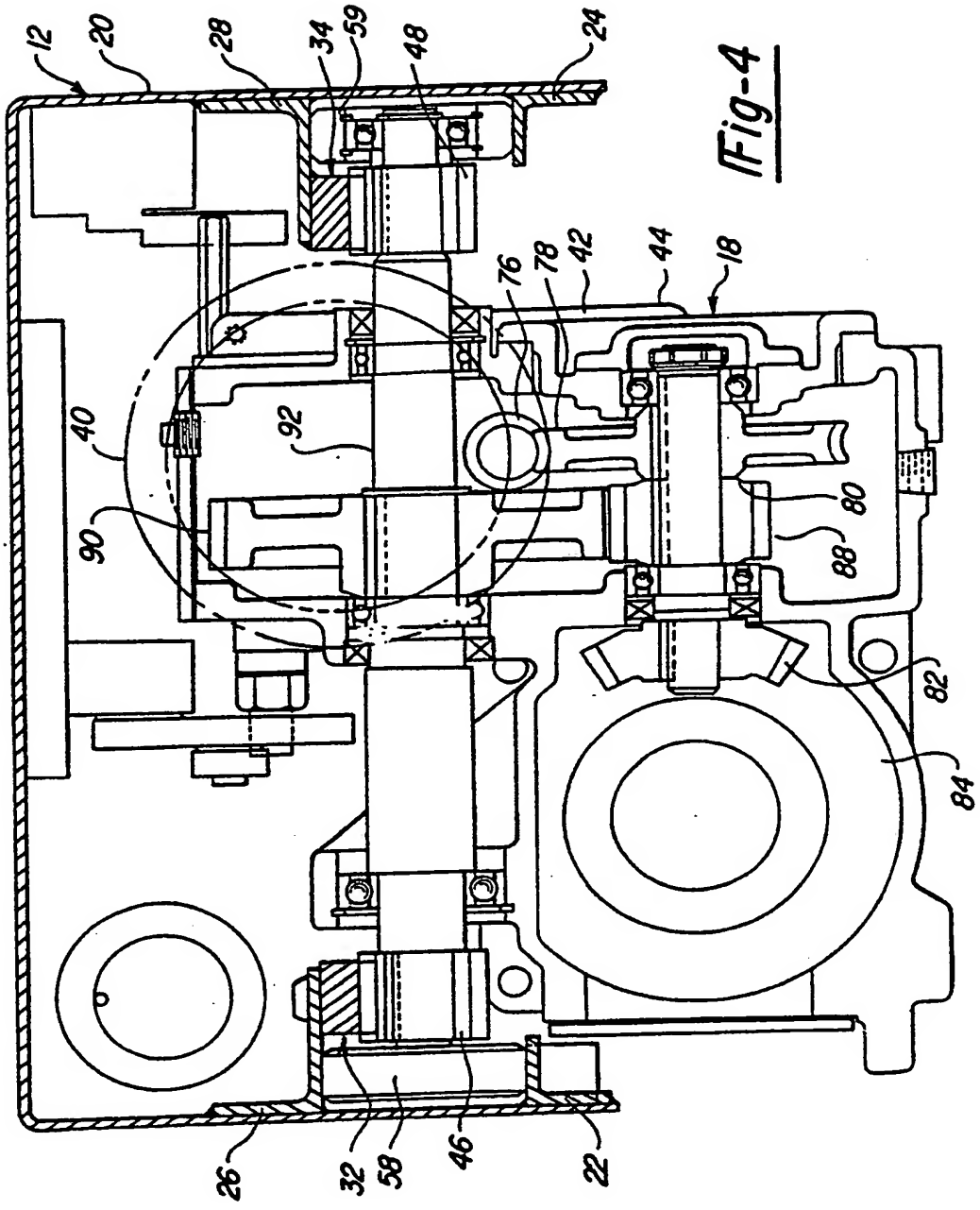
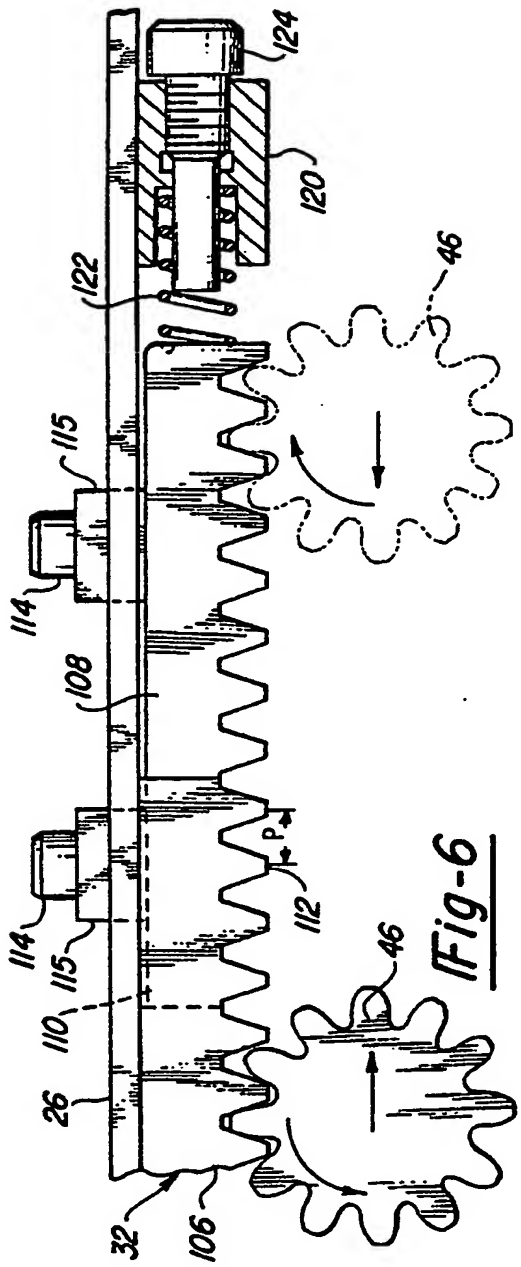


Fig-4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106

Fig-6

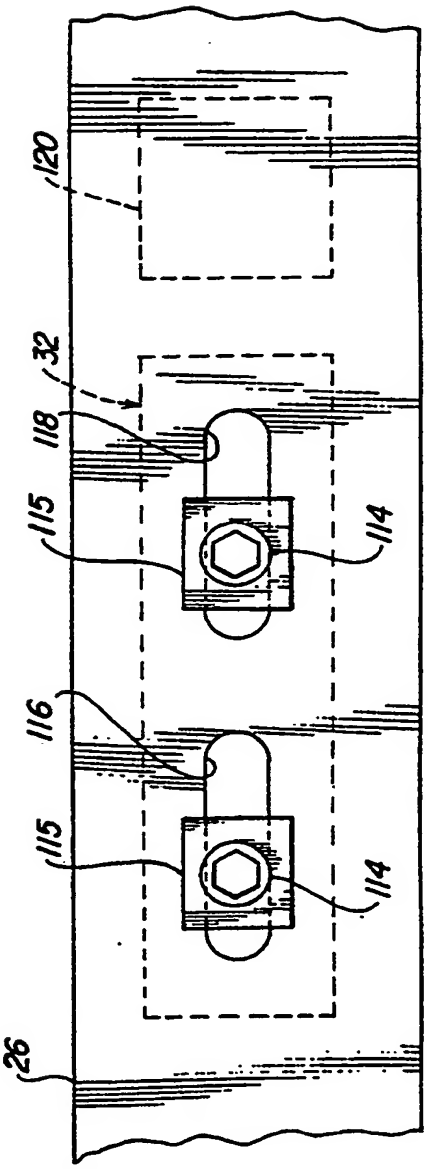
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Fig-7